



SAWTOOTH FISH HATCHERY and EAST FORK SATELLITE

**1991 Spring Chinook Brood Year
and
1992 Steelhead Brood Year**



by

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1991 SPRING CHINOOK SALMON

ABSTRACT

The Sawtooth trap and weir were put into operation on June 7, 1991 and operated through September 15, 1991. A total of 566 spring chinook (231 males, 267 females, and 68 jacks) were trapped, with 238 fish (95 males, 94 females and 49 jacks) released above the weir to spawn naturally. Prespawning mortality of ponded fish totaled 15 and included 4 males and 11 females for a 4.4% prespawning mortality rate.

Spawning began on July 30 and continued through September 10 with 13 spawning days total. We spawned 166 females and 151 males for 922,000 green eggs (5,554 eggs per female), which yielded 794,800 eyed eggs for an eye-up rate of 86.2%. From these eyed eggs, 793,908 fry were ponded, which resulted in a smolt release of 774,583 fish (613,011 released in October 1992 and 161,572 released in April 1993).

The East Fork Satellite fish trap and velocity barrier were put into operation on June 3, 1991 and was operated through September 5, 1991. A total of 62 spring chinook (39 males, 17 females, 6 jacks) were trapped with, 43 fish (31 males, 9 females, and 3 jacks) being released to spawn naturally. Prespawning mortality included one female and one male for a 3.2% prespawning mortality rate.

Spawning at the East Fork started August 15 and continued through August 26, 1991 with five spawning days total. A total of 7 males and 7 females were spawned, yielding 40,400 green eggs, for a fecundity rate of 5,771 eggs per female. These green eggs resulted in 36,500 eyed eggs for an eye-up rate of 90.3%. From these eyed-eggs, we ponded 36,300 fry that were reared at Sawtooth and planted 35,172 smolts in the East Fork in April, 1993.

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INTRODUCTION

Funding Source

Sawtooth Fish Hatchery is part of the U.S. Fish and Wildlife Service Lower Snake River Compensation Plan (LSRCP) and has been in operation since 1985. The hatchery and satellite facility was built by the Corp of Engineers and is funded through the U.S. Fish & Wildlife Service.

Location

Sawtooth Hatchery is located five miles south of the town of Stanley, with its 71 acres bordering the Salmon River to the west, Highway 75 to the east, and U.S. Forest Service ground to the south and north. The Sawtooth weir is roughly 400 miles from Lower Granite Dam and 950 miles from the mouth of the Columbia River. Chinook are released directly into the river at the hatchery and above the hatchery in the headwaters of the Salmon. Sawtooth steelhead are released at the hatchery, along the lower Salmon, and various other drainages around the state.

Sawtooth Hatchery has operated a satellite facility on the East Fork- of the Salmon River since 1984. It is 18 miles from its confluence with the main Salmon River, and that confluence is 42 miles downriver from Sawtooth Hatchery. The property was purchased from the Bureau of Land Management and is surrounded by private land. An access road easement was purchased from a private landowner who has property surrounding the location. The east side of the property borders the East Fork of the Salmon River. Historically, all East Fork chinook have been returned to the East Fork.

Species Reared

Sawtooth Hatchery is involved in trapping, spawning, and rearing spring chinook salmon to the smolt stage for release. We also trap, spawn, and incubate to eye-up "A" run steelhead and transfer their eggs to other facilities.

The East Fork facility handles spring chinook as well as "B" run steelhead. The eggs from fish spawned at the East Fork are transferred to Sawtooth Hatchery for rearing.

Broodstock History

Historically, all of Sawtooth's and East Fork's brood sources have come from the upper Salmon River and East Fork, respectively. There was some introduction of Rapid River stock at the Sawtooth site and in the headwaters of the Salmon River in the late 1970s and early 1980s as fry and smolt plants, but survival was poor and is believed not to have had an affect on our current broodstock. At both facilities some fish are released to spawn naturally. At Sawtooth, about one-third of the steelhead and salmon are released, while one-half are released at the East Fork. An historical synopsis of releases and returns is shown in Appendix D.

Both facilities have been relatively disease-free, although Sawtooth and East Fork chinook have had a high incidence of Bacterial Kidney Disease (BKD) and

a minor incidence of whirling disease. The incidence of BKD is being reduced by feeding and injecting erythromycin and by segregating high BKD parents' progeny from the rest of the population. This segregation starts at the eye-up stage and continues until release (smolt stage). Whirling disease is reduced by keeping the fry on well water for as long as possible before moving them outside on river water (See Fish Health section for more information).

OBJECTIVES

Mitigation Goals

As part of the Lower Snake River Compensation Plan, Sawtooth Hatchery's mitigation goals are expressed in adult returns over Lower Granite Dam. This goal is 19,000 adults.

Idaho Fish and Game Objectives

Idaho Fish and Game's objectives are:

1. To produce 2.4 million smolts for release, of which up to one million of the East Fork-origin smolts will be returned to the East Fork of the Salmon River.
2. Produce quality fish for supplementation programs.
3. Implement research programs at the hatchery to improve returns to the hatchery.

FACILITY DESCRIPTION

Hatchery Description

Sawtooth Hatchery is located five miles south of Stanley, Idaho, in the Sawtooth National Recreation Area and occupies 71 acres of ground at an elevation of 6,480 feet. The landscaping and construction was done to minimize the impacts upon the natural environment.

The hatchery's main building is 134 ft by 166 ft and consists of an office, meeting room, lab, visitor/interpretive center, wood shop, welding/fabrication shop, intake collection box/chemical room, shop office, incubation and early rearing room, one inside storage room and two outside covered storage areas, generator room, furnace room, and a feed freezer/chemical equipment room. The hatchery has four pump houses (each is 14 ft x 11 ft), of which one is for domestic water and three are production wells. An intake building (15 ft x 37 ft) is located one-half mile upstream from the hatchery, and Salmon River water is collected for outside production rearing. The temporary employee dorm and adult spawning facility are located 300 yards downstream of the hatchery building. The dorm (38 ft x 72 ft) has three bedrooms with a bath in each, attached public rest-room facilities, storage and laundry room, living and dining room with an open kitchen. It can sleep 12 people. The adult facility consists of three adult ponds and an enclosed spawning shed (35 ft x 52 ft). There are five resident houses at Sawtooth, all about 1,360 square ft with attached single car garages and separate wood sheds.

The East Fork has a roof structure over a 28 ft travel trailer that is used as a residence. while the trap is in operation. The other building is a combination shop, storage, and spawning shed (22 ft x 44 ft).

Production Capabilities

Production capacities at the East Fork trap consists of two 68 ft x 10 ft x 4.5 ft adult holding ponds (3,060 cubic ft) and a 10 ft x 17 ft fish trap. No fish rearing is done at this facility, and all eggs taken during spawning are shipped to Sawtooth.

Production capacities for Sawtooth include 100 stacks of FAL incubators containing 800 trays. These trays can handle up to 5 million chinook or 7 million steelhead eggs. We have 16 concrete inside rearing vats that can be split into three sections with a total volume of 480 cubic ft and a capacity for 100,000 fry each. Our outside rearing consists of 12 concrete fry raceways with 750 cubic ft of rearing space each and 28 concrete production raceways with 2,700 cubic ft of rearing space each.

Each production raceway has a capacity to raise 100,000 chinook to smolt stage, which gives us a total capacity of 2.8 million fish (This number might be cut by 40% given the recently completed density studies.). These production raceways are serial re-use that flow from an upper raceway to a lower one. The adult facility has three concrete holding ponds with 4,500 cubic ft of holding area. Each pond can hold approximately 1,300 adults.

RECOMMENDATIONS

Some recommendations for Sawtooth would include installation of more wells to provide disease-free outside raceway water. This would also negate the winter river water supply problems. An isolated river water source is needed for the adult holding ponds. The current water source is mostly reuse from the raceways and settling ponds and has a tendency to be higher in temperature than the river temperature during adult spring chinook holding.

The only East Fork recommendation would be the construction of separate holding ponds for smolt acclimation.

WATER SUPPLY

Source

Sawtooth Hatchery receives water from the Salmon River and three production wells. Rearing water from the river enters an intake structure located one-half mile upstream from the hatchery building and flows through a 54-inch pipe to a control box located in the hatchery building where final screening is accomplished. These screens have been switched for smaller ones that will pass salmon fry in the spring more easily. Water is then distributed to the indoor vats, outside raceways or adult fish facility.

Incubation water is provided by two production wells or river water, but because of the problem of introducing whirling disease to the vats when using river water, this practice was stopped in 1987. Excess well water is spilled back into the control box for use in the outside raceways.

The East Fork trapping site receives water from the East Fork of the Salmon River via gravity-flow piping throughout the holding ponds. No fish are reared at this facility.

Quantity and Temperature

The wells provide 7.8 cfs of pumped water and temperatures range from 39°F (4°C) in the winter to 52°F (11°C) in the summer (Appendix G). The river provides up to 55 cubic feet per second (cfs) of gravity-flow water and ranges in temperature from 32°F (0°C) in the winter to 68°F (20°C) in the summer.

Water Quality

The last water quality analysis from the collection box at the river was completed in June 1993. Results include hardness at 68 mg/L; total alkalinity as CaCO₃ at 74; bicarbonate alkalinity as CaCO₃ at 74; sp. conductance at 157 (umhos/cm); total ammonia as N at 0.043 (mg/L); total NO₂ + NO₃ as N at 0.073; total Kjeldahl N as N at <0.05 (mg/L); total phosphorus as P at <0.05 (mg/L); ortho phosphate as P at 0.019; and pH at 8.0. The most noticeable variances from the 1985 tests were ortho-phosphate, which was <.003 mg/l in 1985 to .019 mg/l in 1993, and iron, which was 120 ug/l in 1985 to 20 ug/l in 1993. Additional information is shown in Appendix H.

STAFFING

Five permanent personnel are employed at Sawtooth Fish Hatchery: a Fish Hatchery Superintendent III, Joe Chapman; a Fish Hatchery Superintendent I, Phil Coonts; a Utility Craftsman, Jim Nixon; and two Fish Culturists, Bill Stutz and Steve Wingert.

The hatchery budget includes 8 months of fishery technician time, 42 months of bio-aide time, and 27 months of laborer time.

FISH HEALTH

Several programs that will be implemented at Sawtooth Hatchery to help raise a better quality smolt. Outside raceway baffles were tested with two raceways and shade-cover was installed on all the outside raceways. A BKD segregation program was implemented at this hatchery in 1989, with apparent success in limiting mortalities to high BKD raceways.

Important pathogens found at Sawtooth Hatchery are Renibacterium salmoninarum (BKD), Myxobolus cerebralis (whirling disease), Diplostomum spp. (eye fluke), and Cytophaga psychrophilia (Coldwater Disease). Both Myxobolus and Diplostomum have been controlled with concrete raceways. Although Cytophaga is ubiquitous in the environment, Coldwater Disease is not expressed at this hatchery unless stressful conditions predispose the fish to disease.

In times of warm water temperatures or handling, some fish will show the typical signs of this disease. The focus of the fish health program at Sawtooth is control of BKD.

In 1992, protocols stated in the INAD 4333 for Sawtooth Hatchery call for 21-day treatment for production fish and 28-day treatment for high BKD segregation groups. In the future, erythromycin feeding strategies will include protocols which might enhance absorption of the drug.

Although the well at Sawtooth Hatchery is sufficient for early rearing (indoor raceways), supplemental wells are needed to supply disease-free water for outside rearing. This would also negate the winter problems of the river-intake. During the summer, river water temperatures reach 70°F. Cool water could be mixed with river water to maintain optimum temperatures for adult holding. The results of disease sampling are shown in Table 1.

FISH PRODUCTION

Spring Chinook Adult Collection

The chinook trapping season began on June 7, 1991 and continued through September 15, 1991. The East Fork trap was in operation from June 3, 1991 to September 5, 1991. Sawtooth's peak of the run occurred during the first and second week of July (Appendix C1). East Fork's peak occurred during the third week of August (Appendix C2).

Sawtooth Hatchery trapped a total of 566 adult fish, of which 231 were males, 68 were jacks, and 267 were females (Table 2). One-third of the total run was released to spawn naturally above the weir. This included 95 males, 49 jacks, and 94 females (Table 3). The other two-thirds of the run was spawned at the hatchery. Tagging recoveries included 32 AD-clips, 11 LV clips, and 7 RV clips.

The East Fork facility trapped 62 adult fish, of which 39 were males, 6 were jacks, and 17 were females (Table 2). A total of 31 males, 3 jacks, and 9 females were released to spawn naturally above the weir (Table 3). East Fork had 1 AD-clipped and 1 LV-clipped fish return.

Sawtooth Hatchery had a male:female ratio of 53% males and 47% females. The East Fork's male:female ratio was 73% male and 27% female.

Coded wire tag (CWT) recoveries showed 10 four-year-old and 20 five-year-old fish returned to Sawtooth Hatchery. No East Fork snouts had tags in.

Adult Treatments

Sawtooth and East Fork adult chinook were injected with erythromycin phosphate at a rate of 20 mg active per kg of body weight. Injections were given in the dorsal sinus. The Sawtooth ponded adults were treated three times per week in a 1 hour, 175 ppm formalin flush. The East Fork ponded adults were treated with the same flush at a 100 ppm rate. All chinook carcasses were frozen in a freezer trailer and later transported to a rendering plant.

Table 1. Results of disease sampling.

Case #	Stock	Date	Data	
Juvenile samples				
93-21	EF SC	1/29/92	BK(FAT):0/10+	3/8
93-20	SAW SC	1/29/92	BK(FAT):0/10+	
93-35	EF SC	2/11/92	BK(FAT):0/20	
93-36	SAW SC	2/11/92	BK(FAT):0/20	
93-37	SAW SC	7/23/91	BK(FAT):0/20	
93-38	SAW SC	7/23/91	BK(FAT):0/20	
<u>Brood samples-chinook</u>				
91-234	SAW SC	8/12/91	BK(ELIS 1/1	
91-245	SAW SC	8/10/91	BK(ELIS 0/1	
91-235	SAW SC	8/13/92	BK(ELIS 10/11 IPN 0/11; IHN 0/11	
91-257	SAW SC	9/03/91	BK(ELISA 9/40 BK(FAT): 1/40	
91-272	SAW SC	9/06/91	BK(ELISA 7/26 BK(FAT): 4/26	
91-250	SAW SC	8/27/91	BK(ELISA 10/61	
91-256	SAW SC	8/30/91	BK(ELISA 21/59	
91-243	SAW SC	8/20/91	BK(ELIS 16/42 IPN 0/39; IHN 0/39 EIBS 0/52	
91-244	EF SC	8/10/91	BK(ELISA):3/8 IPN 0/11; IHN 0/11	
91-248	EF SC	8/23/91	BK(ELISA):1/2 IPN 0/2; IHN 0/2	
91-251	EF SC	8/26/91	BK(ELISA):4/4 IPN 0/4; IHN 0/4	
91-273	EF SC	9/05/91	ETRS 0/12; WD 0/8 CS 1/12	
<u>Brood samples-steelhead</u>				
93-101	SAW SH	4/05/92	viro 0/9	
93-115	SAW SH	4/08/92	viro 0/4	
93-118	SAW SH	4/08/92	viro 0/19	
93-132	SAW SH	4/12/92	viro 0/19	
93-146	SAW SH	4/16/92	viro 0/28	
93-148	EF SH	4/16/92	viro 0/9	
93-160	SAW SH	4/19/92	viro 0/27	
93-161	EF SH	4/19/92	viro 0/12	
93-165	SAW SH	4/22/92	viro 0/48	
93-175	SAW SH	4/26/92	viro 0/62	
93-176	EF SH	4/26/92	viro 0/4	
93-181	SAW SH	4/29/92	viro 0/25	
93-182	EF SH	4/29/92	viro 0/7	
93-188	SAW SH	5/03/92	viro 0/15	

Table 2. Age class totals from trapped chinook, return year 1991.

	Length (Fk)	Year class	Numbe
<u>Sawtooth</u>			
Males -	< 64 cm	- 3 year old	68
	64-82 cm	- 4 year old	138
	> 82 cm	- 5 year old	93
Females -	< 82 cm	- 4 year old	63
	> 82 cm	- 5 year old	<u>204</u>
	Total	-	566
<u>East Fork</u>			
Males -	< 64 cm	- 3 year old	7
	64-82 cm	- 4 year old	23
	> 82 cm	- 5 year old -	15
Females -	< 82 cm	- 4 year old	0
	> 82 cm	- 5 year old	<u>17</u>
	Total	-	62

Table 3. Age class breakdown by released chinook, return year 1991.

		Length (Fk)	Age Class	Number
Sawtooth				
Males	-	< 64 cm	- 3 year old	- 48
		64-82 cm	- 4 year old	- 57
		> 82 cm	- 5 year old	- 39
Females	-	< 82 cm	- 4 year old	- 17
		> 82 cm	- 5 year old	- <u>77</u>
		Total		- 238
East Fork				
Males	-	< 64 cm	- 3 year old	- 3
		64-82 cm	- 4 year old	- 17
		>82 cm	- 5 year old	- 14
Females	-	< 82 cm	- 4 year old	- 0
		>82 cm	- 5 year old	- <u>9</u>
		Total		- 43

Prespawning Mortality

Sawtooth had 12 pre-spawning mortalities of ponded fish for a 3.6% mortality rate. A total of 3 males and 9 females died prior to spawning at Sawtooth. East Fork lost 1 male and 1 female for a 3.2% overall mortality rate.

Spawning Operations

Sawtooth Hatchery spawned 13 times: July 30; August 2, 6, 9, 13, 16, 20, 23, 27, and 30; September 3, 6, and 10. East Fork spawned 5 times: August 15, 19, 21, 24, and 26.

Sawtooth Hatchery spawned 166 females and 151 males (jacks were not differentiated from males). East Fork spawned 7 females and 7 males. Each female's eggs were split in half. Each half was fertilized by a separate male. The two halves were then recombined. The same procedure was used at The East Fork, except each female's eggs were split into three families instead of two.

Sawtooth took 861,830 green eggs (5,191 eggs per female). East Fork took 38,640 green eggs (5,520 eggs per female). These numbers were derived from good and bad egg counts from the egg-picking machine.

After fertilization, the eggs were rinsed with well water until all the sperm and blood was removed. A minimum 100 ppm Argentynine (10% iodine) solution was added to the eggs for one hour. The eggs were then put into Heath incubator trays, with one female per tray for BKD segregation. Forty-eight females had a low incidence of BKD and 5 females had a high incidence. East Fork had 4 low females and 1 high incidence female (see Fish Health). All of the high incidence eggs were isolated from the production eggs.

Incubation

After water-hardening in the minimum 100 ppm Argentynine solution, the green eggs were put in Heath trays at one female per tray. Each 8-tray Heath stack had 5 gpm of well water supplied to it. All incubated eggs were treated with a 1,667 ppm formalin bath for 15 minutes, 5 times per week for fungal control.

Eggs were put away at one female per tray for BKD segregation. This averaged about 45 oz, or about 5,200 eggs per tray. An additional 150,500 eyed eggs from Pahsimeroi Hatchery were incubated at Sawtooth.

Well temperatures dropped from 50°F to 41°F during the incubation period (Appendix G). The eggs eyed-up around 480 TU's. They were shocked around 530 TU's and hatched around 1,300 TU's.

Sawtooth green eggs eyed up at a 86.2% rate, yielding 742,530 eyed eggs (Appendix F). East Fork green eggs eyed up at a 90.3% rate, yielding 34,890 eyed eggs. The eyed eggs were shocked by putting the eggs in a half-full 3-gallon bucket of water, then pouring that bucket into a quarter-full bucket of water from about three feet high.

One day after shocking, the eggs were machine-picked using a Jenn-sorter model JH machine, which sorts and enumerates eggs. A day or two after machine-picking, the eyed eggs were hand-picked. The eggs are again hand-picked two weeks after machine-picking, then once again before swim-up.

Early Rearing

The swim-up fry were kept at a high density during feed training (1.2 lbs/cubic ft) until all the fish were on feed. After all the fish were eating well, rearing volumes were increased and densities decreased to 0.15 lbs/cubic ft. The fingerlings were moved to the final rearing raceways when densities began to approach 0.8 lbs/cubic ft.

The swim-up fry were transferred from the Heath trays to epoxy-painted cement vats for early rearing in December through mid-January. The vats contained PVC baffles every four feet. The vats are 4 ft wide x 3 ft deep x 40 ft long, with key-ways to allow lengths of either 10 ft, 20 ft, or 40 ft, thus creating rearing volumes of 120, 240, or 480 cubic ft.

Starting flows for the swim-up fry were set at 20 gpm per vat. As the fish grew, the flows were increased to 110 gpm. Early rearing well water varied in temperature from 44°F at swim-up to 40°F when the fish were moved to the final rearing raceways (Appendix G).

All fry were started on Bio-Products Bio-Diet Starter #1 and #2. Feed amounts and sizes varied as the fish grew. All fish were fed a prophylactic treatment of erythromycin during March at a rate of 4.5 grams active/100 lbs of fish. A feed schedule is shown in Table 4.

This was the third year of rearing/density studies. Three vats were loaded with 30,000 fry, three vats were loaded with about 65,000 fry, and three vats were loaded with about 100,000 fry (standard). This study began two years ago and will finish with brood year 1991.

The fish were transferred to the final rearing raceways around 150 fpp during late May and early June.

The fingerlings from the Pahsimeroi Hatchery were transferred back to them during May.

Final Rearing

The outside raceways are concrete, measuring 12 ft wide x 2.3 ft deep x 100 ft long, yielding 2,700 cubic ft of rearing space. Starting densities outside averaged 0.15 lbs/cubic ft. The densities increased to 0.47 lbs/cubic ft in the low density raceway to 1.9 lbs/cubic ft in the high density raceways before the fish were released.

Initial flows were set at 500 gpm per raceway and increased to 1,000 gpm during the heat of the summer. River water supplies the outside raceways, so daily temperatures fluctuate up to 19°F. Seasonal variances range from lows of 32°F during winter to 69°F in summer (Appendix G).

All outside fish were fed a diet of Bio-Products Grower feed. All outside fish were fed a 21-day prophylactic treatment of erythromycin at a rate of 4.5 grams active per 100 pounds of fish to prevent the onset of BKD. The high BKD fish were fed a 28-day treatment of erythromycin.

The density study initiated in the inside rearing vats was continued in the outside raceways.

All outside raceways were fitted with shade-covers, which were utilized by the fish. No sunburn was observed during outside rearing. Three raceways were

Table 4. Feed schedule for Sawtooth Hatchery spring chinook, brood year 1991.

fpp	% body weight fed	time span
swim-up - 800	.035	12/15/91 - 01/15/92
800 - 500	.033	01/16/91 - 02/28/92
500 - 400	.028	03/01/91 - 03/15/92
400 - 350	.025	03/16/91 - 03/24/92
350 - 300	.023	03/25/91 - 04/01/92
300 - 250	.02	04/02/91 - 04/14/92
250 - 150	.022	04/15/91 - 06/01/92
150 - 110	.024	06/02/91 - 06/28/92
110 - 90	.028	06/29/91 - 07/04/92
90 - 50	.03	07/05/91 - 08/15/92
50 - 25	.028	08/16/91 - 09/25/92
25 - 21	.024	09/26/91 - 10/15/92
≤25	maintenance	10/15/91 - release

used experimentally with meandering baffles, logs, stumps, and willow clumps in the raceways. The stumps and willow clumps had to be removed because there was no way to clean the accumulated feed off them. This could have caused disease problems. Two of these experimental raceways also had five catchable trout put into them to act as predators to the fingerlings. Stomach analysis showed the trout did prey upon the chinook.

The brood year 1991 chinook, weighing 31,640 pounds, were fed 57,950 pounds of feed for a conversion of 1.83. This figure includes the East Fork group. Both groups are shown in the cost analysis in Appendix I.

Fish Marking

All of the hatchery's fish were given a mark during September 14-23, 1992. A total of 524,725 fish were adipose-clipped and given a CWT. Another 249,858 fish were given an RV clip to identify them for the supplementation program. Any returning adults with an LV or RV clip, denoting supplementation fish, in 1993, 1994, and 1995 will be released to spawn naturally. The PIT tags are to evaluate downriver migration. A summary of marking is shown in Table 5 and broken down further in Appendix J.

Fish Distribution

Fish distribution for brood year 1991 began in October of 1992 with the planting of the supplementation fish in the headwaters of the Salmon. After being delayed by National Marine Fisheries Service (NMFS), a volitional release was initiated on April 2, 1992 for the Sawtooth chinook. Approximately one-third to one-half of the smolts emigrated from the raceways before the boards were pulled, and the remaining fish were flushed into the river on April 5, 1993 (Appendix E).

After being delayed by NMFS, the East Fork chinook smolts were trucked five and ten miles above the weir pool on April 20, 1993. A summary of all the smolt releases is shown in Appendix E.

Table 5. Summary of marked chinook released, return year 1991.

	Sawtooth	East Fork
Total CWT	524,725	0
CWT + PIT	4,800	0
LV clip only	0	35,172
LV + PIT	1,500	350
Total RV	249,858	0
RV + CWT	198,039	0
RV + CWT + PIT	2,400	0
RV + PIT	800	0
TOTALS	774,583	35,172

1992 STEELHEAD

ABSTRACT

The Sawtooth trap and weir were put into operation on March 2, 1992, and closed April 30, 1992. A total of 1,705 adult steelhead (1,206 males and 499 females) were trapped at the Sawtooth weir. A total of 672 steelhead were released above the hatchery to spawn naturally. This included 497 males (26 wild) and 175 females (18 wild). Prespawning mortality at Sawtooth Hatchery totalled 11 fish (six males and five females).

Spawning began on March 26 and continued through April 25, with eight spawning days occurring. Three hundred and seven females were spawned at Sawtooth yielding 1,406,360 green eggs for an average fecundity of 4,581 eggs per female. These green eggs resulted in 1,182,500 eyed eggs for an eye-up percentage of 84.1%. The eggs were shipped to Hagerman National Hatchery for rearing.

The East Fork velocity barrier and trap was put into operation March 18, 1992 and ran through May 4, 1992. A total of 156 adult steelhead were trapped. This included 91 males and 65 females. Fish released above the weir to spawn naturally included 38 males (23 wild) and 28 females (22 wild). A temporary weir was operated on the East Fork from March 27 to April 10, 1/4 mile above the mouth of the East Fork. This trap collected information on run timing and drop-out of adults prior to arriving at the satellite facility. A total of 116 hatchery fish were tagged, with only 17 of them swimming into the upper trap. The weir was pulled prematurely due to confrontations with Shoshone-Bannock Tribal members.

Spawning operations began on April 6, 1992 and continued through April 27, 1992 with seven spawning days occurring. Thirty-seven females were spawned, yielding 150,790 green eggs for an average fecundity of 4,075 eggs per female. These green eggs resulted in 135,200 eyed eggs for an 89.7% eye-up rate. These eggs were shipped to Magic Valley Hatchery for rearing.

An additional 3,222,640 green eggs from Pahsimeroi Hatchery were incubated at Sawtooth. These eyed up at a 76.1% rate, yielding 2,453,900 eyed eggs. These eyed eggs were shipped to the following hatcheries: Magic Valley received 1,031,000, Niagara Springs received 696,750, and Hagerman National received 726,250.

The smolts raised from all the eyed eggs were released at the Sawtooth weir, East Fork weir, and various locations around the state during the spring of 1993. Sawtooth stock smolts were released at the following locations: Sawtooth acclimation raceways - 107,299; Warm Springs Bridge - 432,685; Hammer Creek - 211,006; and Hazard Creek - 92,841. Pahsimeroi stock incubated at Sawtooth Hatchery were released at Sawtooth acclimation raceways - 562,271; Sawtooth direct release - 59,950; Slate Creek - 187,100; Challis - 260,600; Ellis - 266,300; Lemhi - 198,500; and North Fork - 190,500. East Fork stock smolts numbering 106,400 were released upriver of the East Fork satellite facility. An additional 391,000 Dworshak smolts were released at the weir site.

Authors:

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FISH PRODUCTION

Steelhead Adult Collection

The Sawtooth weir and trap was put into operation on March 2, 1992 and continued through April 30, 1992. The East Fork trap was put into operation March 11, 1992 and ran through April 20, 1992. The peak of the Sawtooth run occurred the first week of April, while the peak of the East Fork run occurred the second week of April (Appendix C3 and C4).

Sawtooth Hatchery trapped a total of 1,705 adult fish, which included 1,206 males and 499 females (Table 6). Two-hundred and thirty-eight of these had LV or RV clips. Sixty-six of the clipped fish had tags. A total of 497 males (26 wild) and 175 females (18 wild) were released above the weir to spawn naturally. All wild fish were released, along with enough hatchery fish to equal one-third of the total run. The other two-thirds of the run was spawned at the hatchery.

The East Fork facility trapped 156 adult fish, of which 91 were males and 65 were females (Table 6). A total of 38 males (23 wild) and 28 females (22 wild) were released above the velocity barrier to spawn naturally. All wild fish were released, along with enough hatchery fish to equal one-third of the total run. The other two-thirds of the run was spawned at the facility. East Fork had 22 clipped fish return, with 13 of those fish having tags. The length frequency distribution of steelhead from Sawtooth and the East Fork is shown in Appendix A.

Sawtooth had a male:female ratio of 71% males and 29% females. The East Fork's male:female ratio was 58% male and 42% female.

Using Kent Ball's (IDFG Anadromous Researcher) lengths for 1- and 2-ocean fish, steelhead returns by year class and sex are shown in Table 6.

From the 66 CWT fish recovered, the information said that 5 of these fish were four-year-olds and 61 of the fish were three-year-olds. From the 13 East Fork CWT recovered, 4 were four-year-olds and 8 were three-year-olds, and 1 fish was unknown. Released steelhead by adult year class and sex are shown in Table 7.

Adult Treatments

The returning adults at Sawtooth Hatchery and East Fork Satellite are not treated or injected with any type of drug or chemicals prior to spawning.

Prespawning Mortality

Sawtooth Hatchery had a prespawning mortality of 1.06%, or 6 males and 5 females. The East Fork facility had no pre-spawning mortality.

Spawning Operations

Sawtooth Hatchery spawned steelhead on eight different days: March 27, 30, April 3, 6, 9, 13, 16, and 20. Spawning took place seven times at the East Fork:

Table 6. Steelhead returns by year class^a and sex, return year 1992.

Sawtooth

2 year old males - - - -	1,124
3 or 4 year old males- -	<u>82</u>
	1,206 males
2 year old females - - - -	313
3 or 4 year old females - -	<u>-186</u>
	499 females

East Fork

2 year old males - - - -	39
3 or 4 year old males- -	<u>52</u> males
	91
2 year old females- - -	12
3 or 4 year old females - -	<u>53</u>
	65 females

^aThese figures are based on Kent Ball's criteria for aging steelhead, as described in Table 8.

Table 7. Released steelhead by year class^a and sex, return year 1992.

Sawtooth

Males - 2 year old -	442	Females - 2 year old -	110
3 or 4 year old	55	3 or 4 year old -	65
Total -	497	Total -	175

East Fork

Males - 2 year old -	14	Females - 2 year old -	8
3 or 4 year old	24	3 or 4 year old	20
Total -	35	Total -	28

^aThese figures are based on Kent Ball's criteria for aging steelhead, as described in Table 8.

Table 8. Criteria for aging steelhead, from Kent Ball, IDFG.

"A" male -	< 68 cm -	2 year old
	> 68 cm -	3 or 4 year old
"A" female -	< 65 cm -	2 year old
	> 65 cm -	3 or 4 year old
"B" male -	< 73 cm -	2 year old
	> 73 cm -	3 or 4 year old
"B" female -	< 68 cm -	2 year old
	> 68 cm -	3 or 4 year old

April 6, 9, 12, 16, 20, 24, and 27. Both facilities used two males per female, pooling the males' sperm, then combining it with the females's eggs.

At Sawtooth, 669 fish were spawned, of which 307 were females. The East Fork facility spawned 90 fish, of which 37 were females. Using the Von Bayer egg enumeration method, 1,406,360 green eggs were collected from Sawtooth fish (4,581 per female) and 150,790 green eggs were taken from East Fork fish (4,075 per female).

After fertilization, the eggs were rinsed of blood and sperm with well water. Then the eggs were hardened in a minimum 100 ppm solution of Argentyne (10% iodine) solution for one hour before being put into Heath trays for incubation. Two female's eggs were pooled into each tray. After viral test results were received, viral-positive eggs were isolated from viral-free eggs.

Incubation

After hardening in an Argentyne solution, the green eggs were put away at two females per Heath tray. Initial water flow was set at 4 gpm of well water per stack and increased to 5 gpm at eye-up.

An additional 3,222,640 green eggs were received from Pahsimeroi Hatchery and incubated at Sawtooth. These eggs were incubated at two females per- Heath tray.

All incubated eggs were treated with a 1,667 ppm 15-minute formalin bath five times per week for fungal and bacterial control. Sawtooth's eggs eyed up at an 84.1% rate, yielding 1,182,500 eyed eggs (Appendix F). East Fork's eggs eyed up at an 89.7% rate, yielding 135,200 eyed eggs. Pahsimeroi eggs incubated at Sawtooth eyed up at a 76.1% rate, resulting in 2,453,900 eyed eggs.

Well temperatures varied from 38°F at the beginning of incubation to 44°F at the end of incubation. Seven TU's per day was the average during the incubation period. Eye-up occurred around 320 TU's, and the eggs were shocked at 340 TU's.

The eggs were shocked by putting them in a half-full 3-gallon bucket of water, then pouring them into a quarter-full bucket of water from about 3 feet high. One day after shocking, the eggs were machine-picked, using a Jenn-Sorter model JH machine, which picks and enumerates eggs. A day or two after picking, the eyed eggs are hand-picked before transfer to the rearing hatcheries. The eggs were loaded at 50,000 to 80,000 eggs per 48-quart cooler of well water, with two inches of ice added. Then the cooler was strapped shut and shipped. The 1,182,500 Sawtooth eggs were shipped to Hagerman National Hatchery. The 135,200 East Fork eggs were shipped to Magic Valley Hatchery. The Pahsimeroi eggs were shipped as follows: 1,031,000 to Magic Valley Hatchery, 726,250 to Hagerman National Hatchery, and 696,750 to Niagara Springs Hatchery.

Acclimation

Mortality was much lower this year compared to last year, and there was no noticeable difference in mortality through the acclimation raceways this year. The smolts were held from 22 to 34 days. A volitional release began April 9, 1993, but less than 15% of the smolts left. The raceways were flushed empty April 13-15. The smolts left the weir pool within 5-6 days.

Fish Marking

Fish marking was completed in the rearing hatcheries and is shown in Appendix J.

Smolt releases went very smoothly. Very little mortality was seen below the Sawtooth weir and East Fork weir.

CONCLUSION/RECOMMENDATIONS

East Fork Trap

As stated in last year's brood year report, the East Fork's adult returns are insufficient to meet egg needs or escapement goals. With the involved agencies approval, a lower weir and trap would boost our facility's adult numbers.

Sawtooth Hatchery

If the returning number of steelhead adults show that acclimation is a viable program, then we should plan on implementing the program every spring. If acclimation is not proven to be of benefit, it would be desirable to restore the direct release program, one to the possible entrainment of emerging natural chinook fry into the hatchery intake.

A P P E N D I C E S

Appendix A1. Sawtooth chinook length frequency distribution,
return year 1991.

	Fish trapped	Males	Females	Length (in)	Length (cm)
	2	2		14.91	40
				16.54	42
	7	7		17.32	44
	3	3		18.11	46
	4	4		18.91	48
	5	5		19.69	50
	5	5		21.26	52
	0			21.67	54
	3	3		22.05	56
	3	3		22.83	58
	12	12		23.62	60
	11	11		24.41	62
	13	13		25.19	64
	9	9		25.98	66
	24	22	2	26.77	68
	28	26	2	27.56	70
	28	21	7	28.35	72
	29	22	7	29.13	74
	24	12	12	29.92	76
	17	8	9	30.71	78
	21	9	12	31.51	80
	21	9	12	32.28	82
	28	10	18	33.07	84
	37	10	27	33.85	86
	52	18	34	34.65	88
	52	11	41	35.43	90
	47	14	33	36.22	92
	35	8	27	37.01	94
	24	9	15	37.81	96
	12	6	6	38.58	98
	7	4	3	39.37	100
	2	2		40.16	102
	1	1		40.95	104
Totals	566	299	267		

Appendix A2. East Fork chinook length frequency distribution,
return year 1991.

	Fish trapped	Males	Females	Length (in)	Length (cm)
	1	1		15.75	40
	1	1		18.91	48
	1	1		19.69	50
	0	5		21.26	52
	0			21.67	54
	0			22.05	56
	3	3		22.83	58
	0			23.62	60
	0			24.41	62
	1	1		25.19	64
	1	1		25.98	66
	3	3		26.77	68
	6	6		27.56	70
	2	2		28.35	72
	4	4		29.13	74
	4	4		29.92	76
	2	2		30.71	78
	0	0		31.51	80
	1	1		32.28	82
	7	7		33.07	84
	3		3	33.85	86
	2		2	34.65	88
	6	1	5	35.43	90
	4	2	2	36.22	92
	2	1	1	37.01	94
	3	2	1	37.81	96
	1	1		38.58	98
	2	2		39.37	100
	2	2		40.16	102
Totals	62	45	17		

Appendix A3. Length frequency distribution of Sawtooth steelhead, return year 1992.

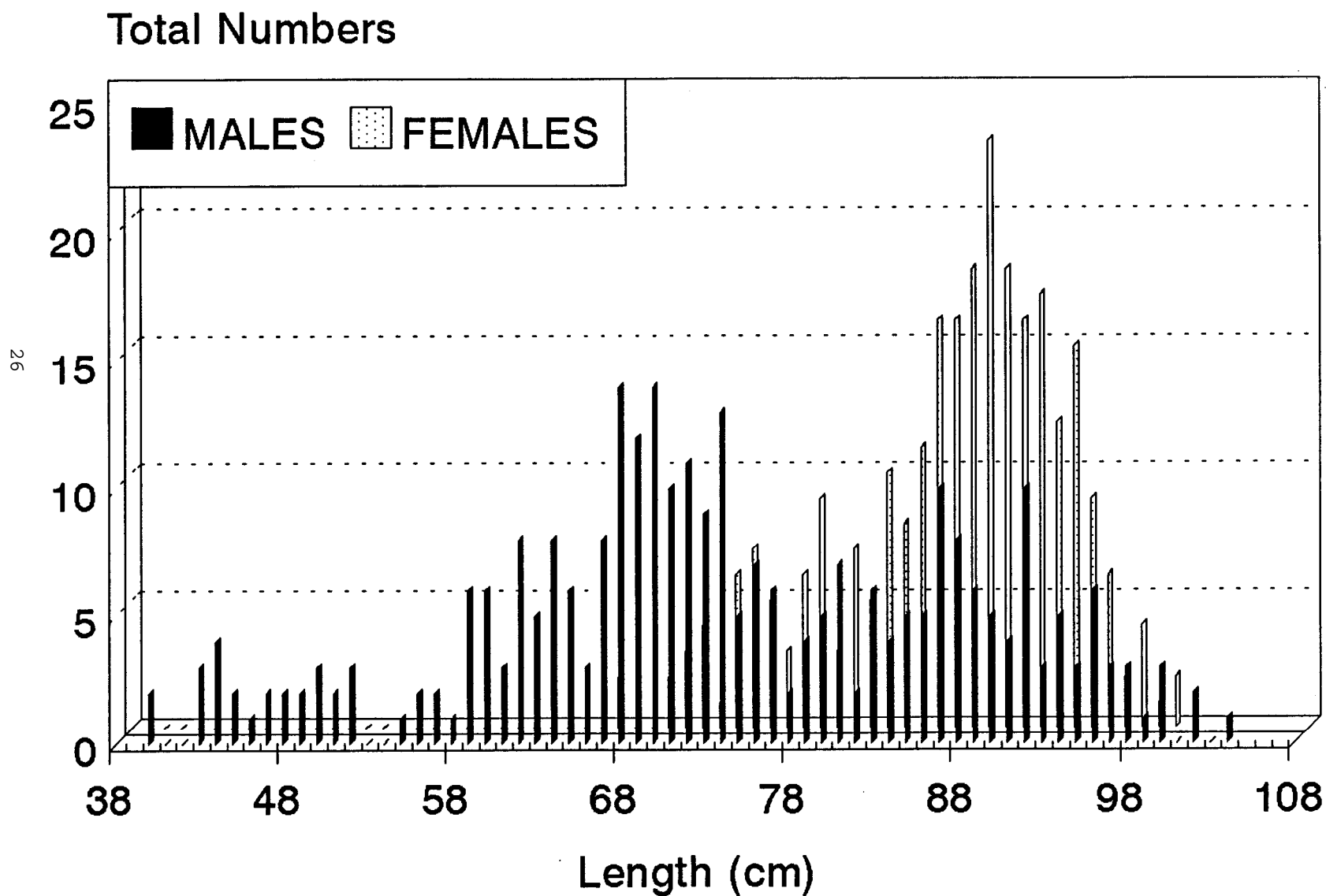
Length (cm)	Hatchery males	Wild males	Hatchery females	Wild females	Total
46	1				1
50	1	1			2
51	2		2		4
52	7		2		9
53	4			1	5
54	19		7		26
55	32		8		40
56	62		11		73
57	59	1	26		86
58	97	2	44		143
59	132	3	35	3	173
60	140	4	44	3	191
61	108	1	28	1	138
62	129	3		24	156
63	91	1	26		118
64	81	3	33	2	119
65	58		12	1	71
66	38		10	1	49
67	26		12		38
68	17	1	23	1	42
69	16	1	25		42
70	10		23	2	35
71	5		22		27
72	7	1	27	1	36
73	9	1	14		24
74	11		12		23
75	5		3	1	9
76	5	1	2		8
77	1		3		4
78	4		3	1	8
79	2	1			3
80	1	1			2
Totals	1,180	26	481	18	1,705

Appendix A4. Length frequency of East Fork steelhead, return year 1992.

Length (cm)	Hatchery males	Wild males	Hatchery females	Wild females	Total
44		1			1
54				1	1
55					
56					
57	1				1
58	1	1			2
59	1	1			2
60	4			2	6
61	3	1		1	5
62	1		1	1	3
63	3	1		1	5
64	4	1	2		7
65	4				4
66	1		1	1	3
67	3			1	4
68					
69	2		1	1	4
70	1		4		5
71	1		2		3
72	2	1	3	2	8
73		3	2	3	8
74	3		3	1	7
75	3	1	6	1	11
76	1		6	1	7
77	3	1	5	2	11
78	3	2	1	1	7
79	7	3	3	1	14
80	4	2	1		7
81	3	1	1		5
82	1				1
83	2	1			3
84	4	2			6
85					
86	1				1
87			1		1
88	2			1	3
Totals	68	23	43	22	156

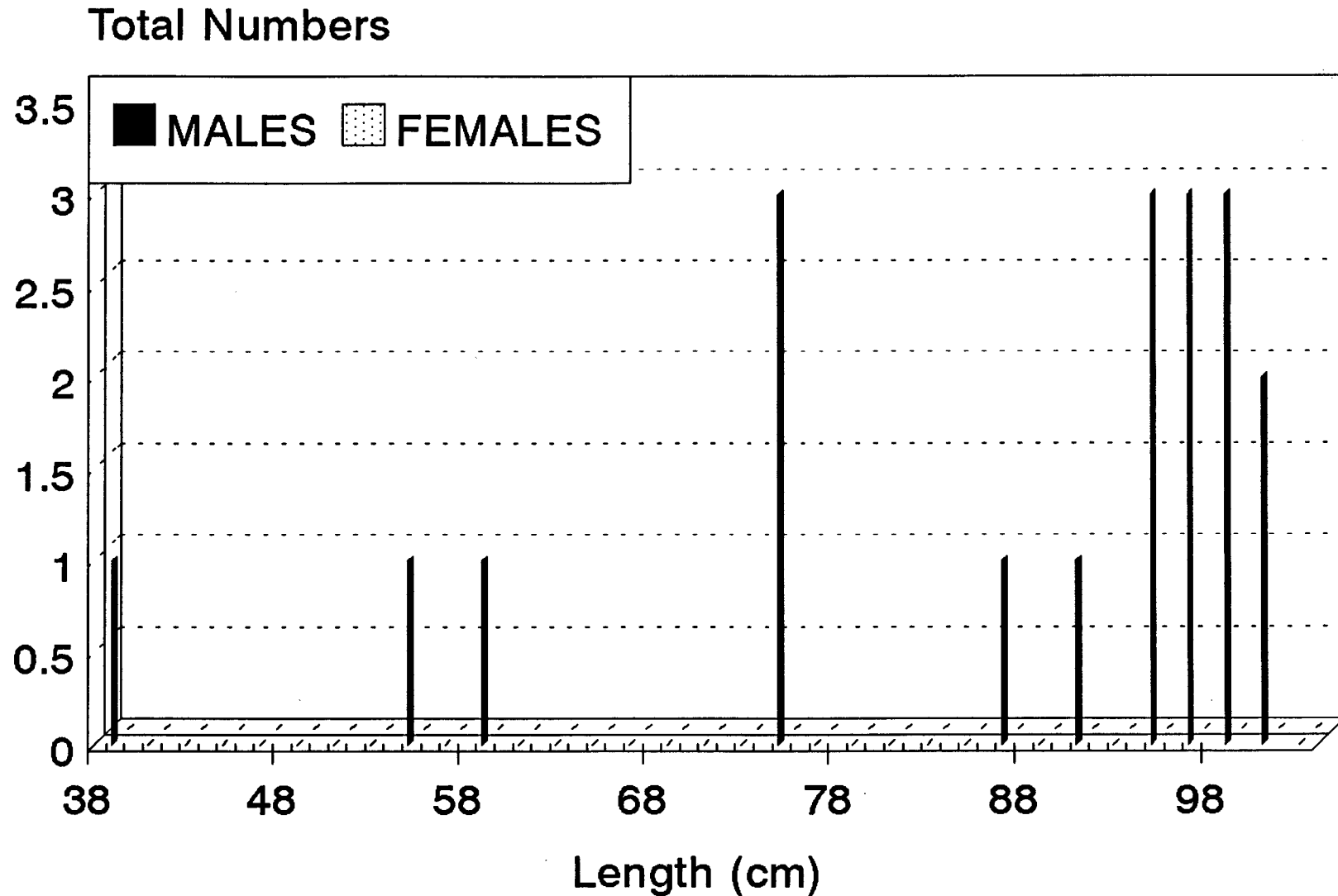
SAWTOOTH CHINOOK LENGTH FREQUENCY DISTRIBUTION

1991 n=566



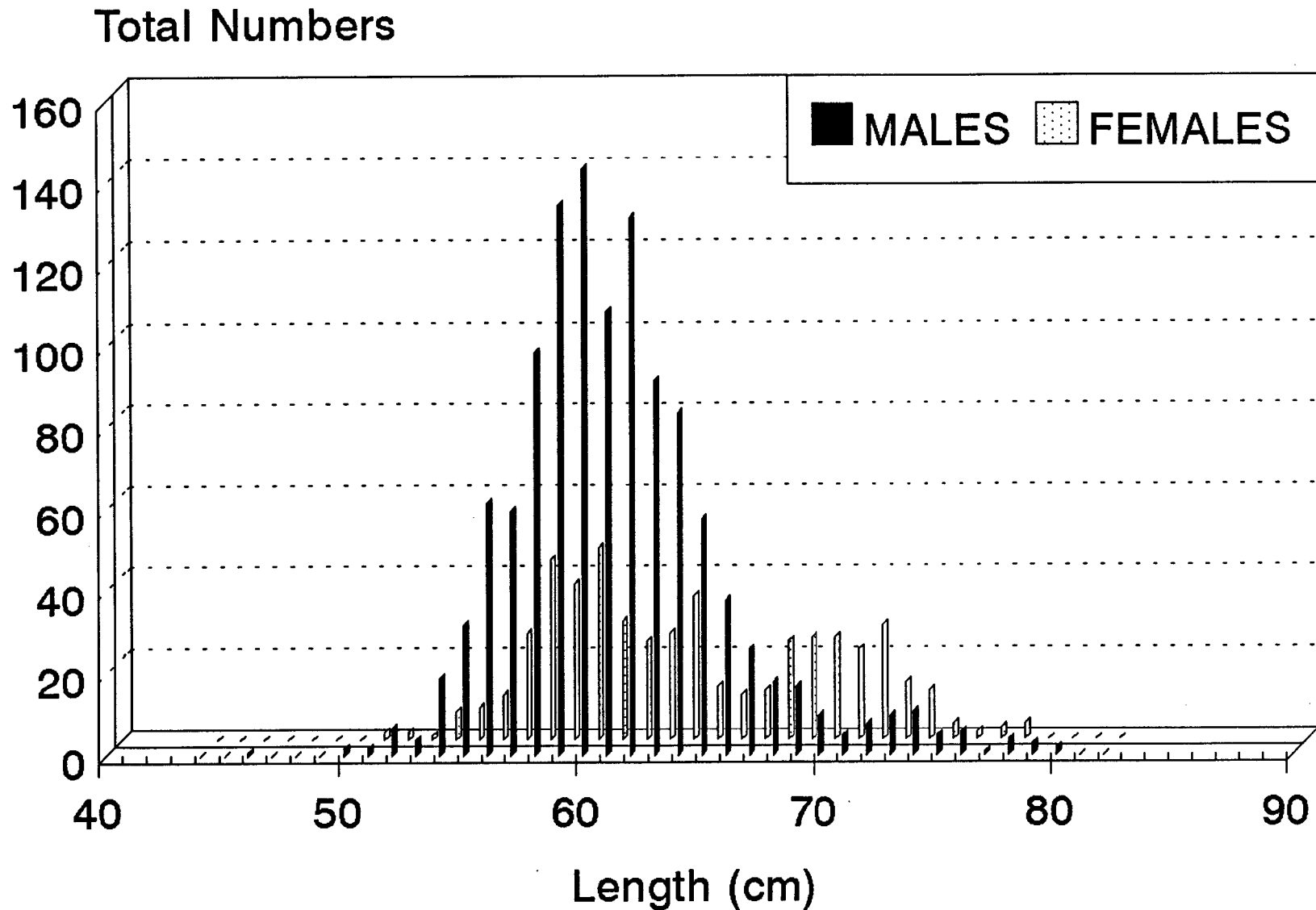
EAST FORK CHINOOK LENGTH FREQUENCY DISTRIBUTION

1991 n=145

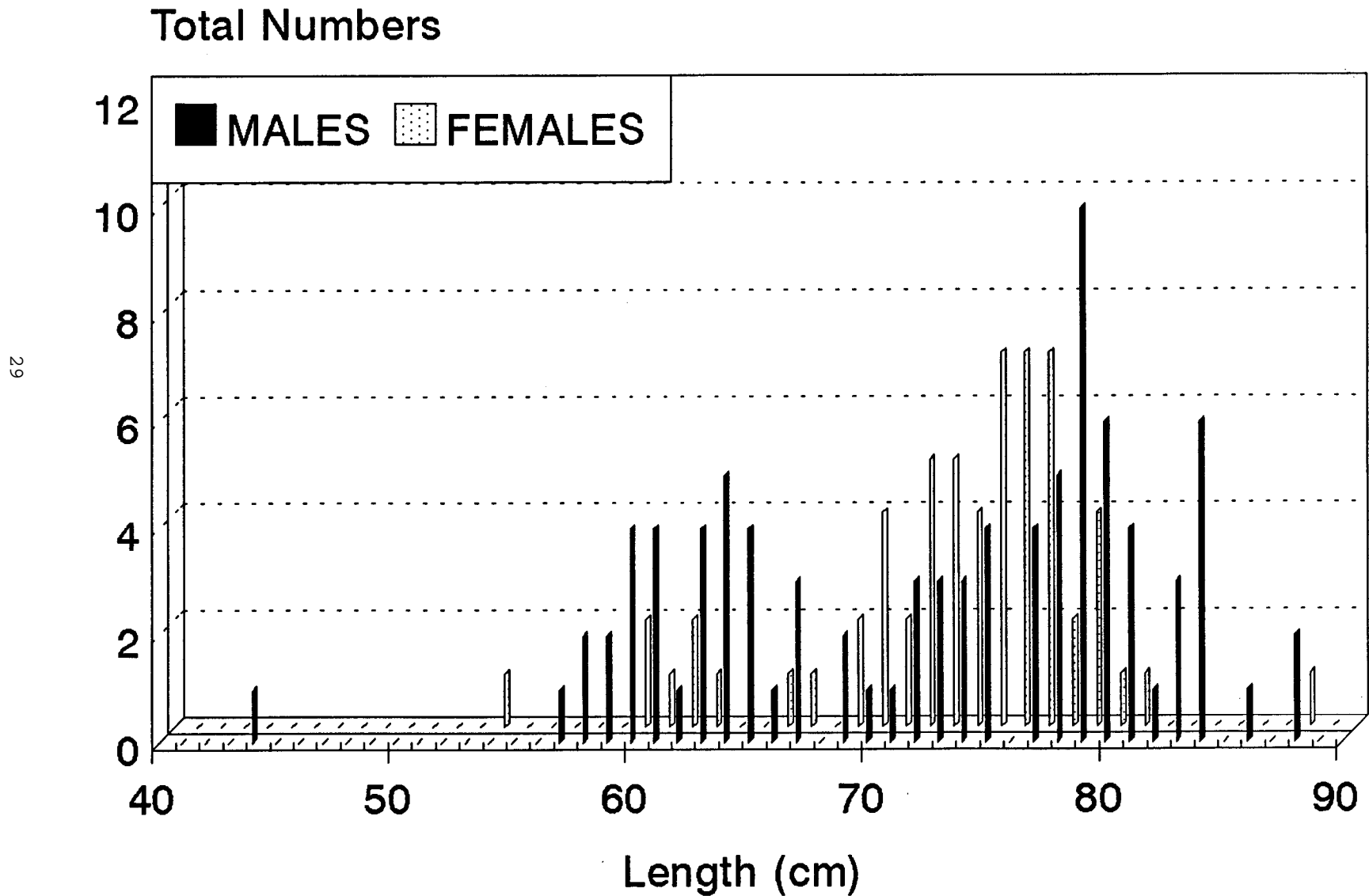


SAWTOOTH STEELHEAD LENGTH FREQUENCY DISTRIBUTION

1992 n 1,705

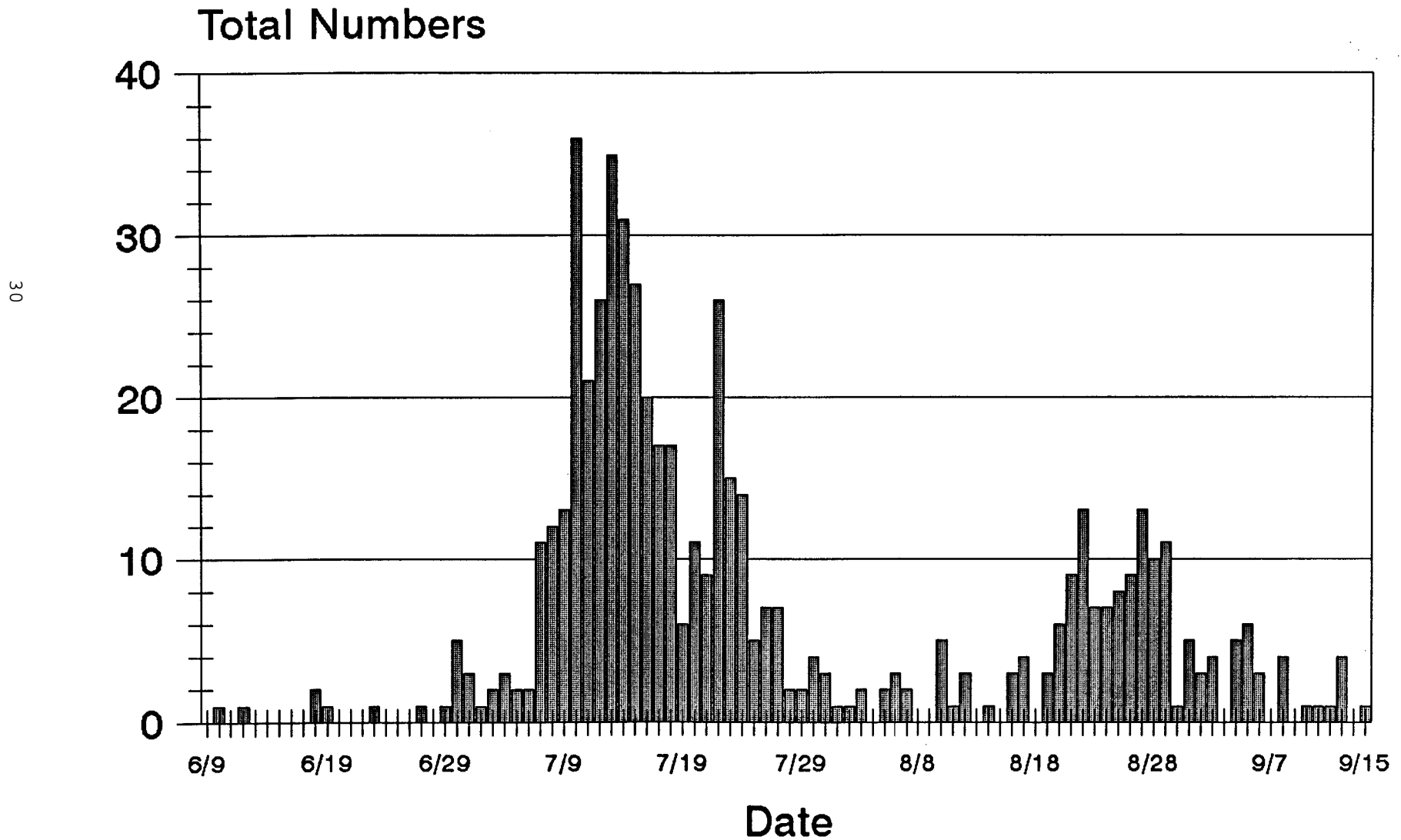


EAST FORK STEELHEAD LENGTH FREQUENCY DISTRIBUTION 1992 n=156



SAWTOOTH CHINOOK RUN TIMING

n-566

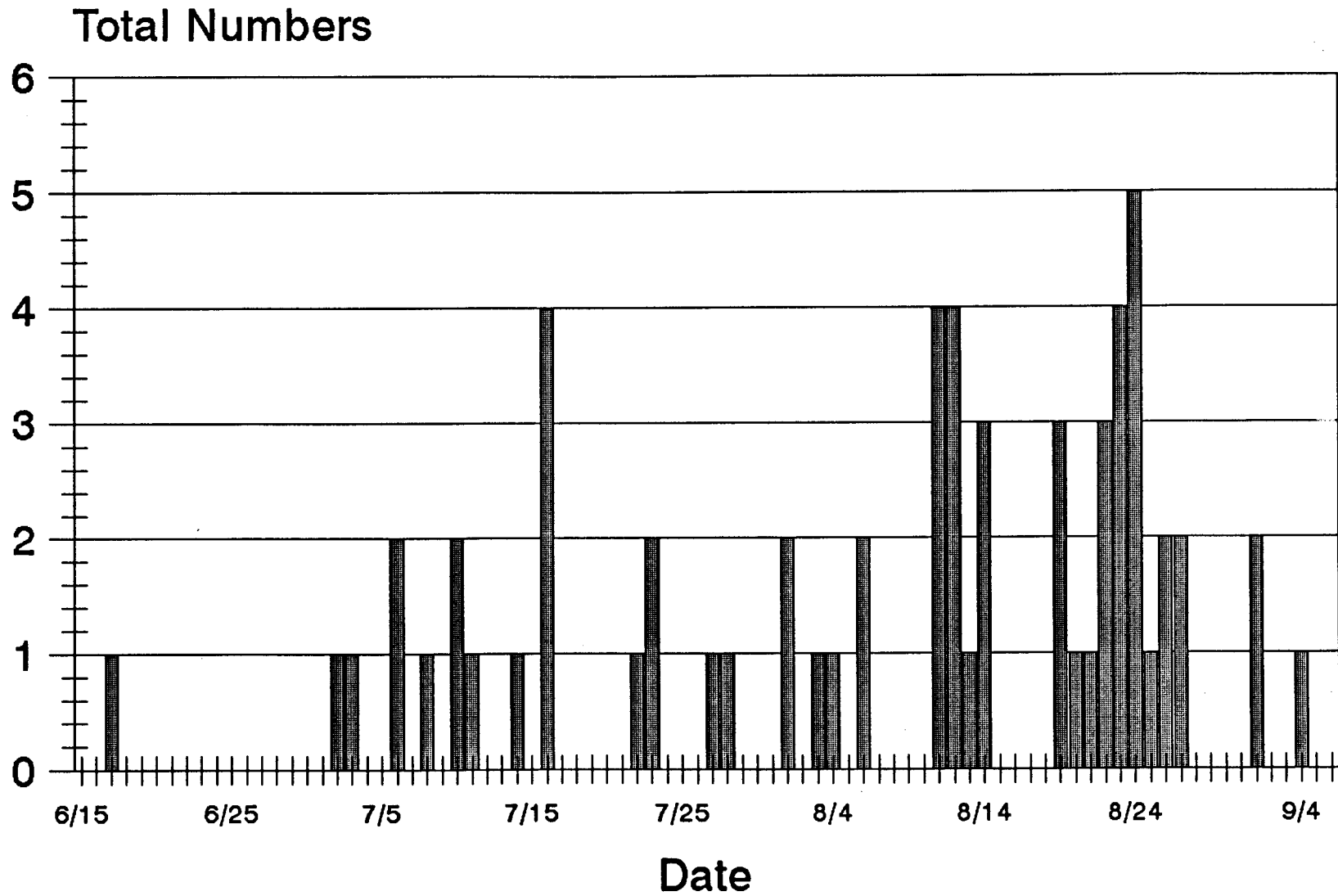


Appendix C1. Sawtooth chinook run timing, 1991.

EAST FORK CHINOOK RUN TIMING

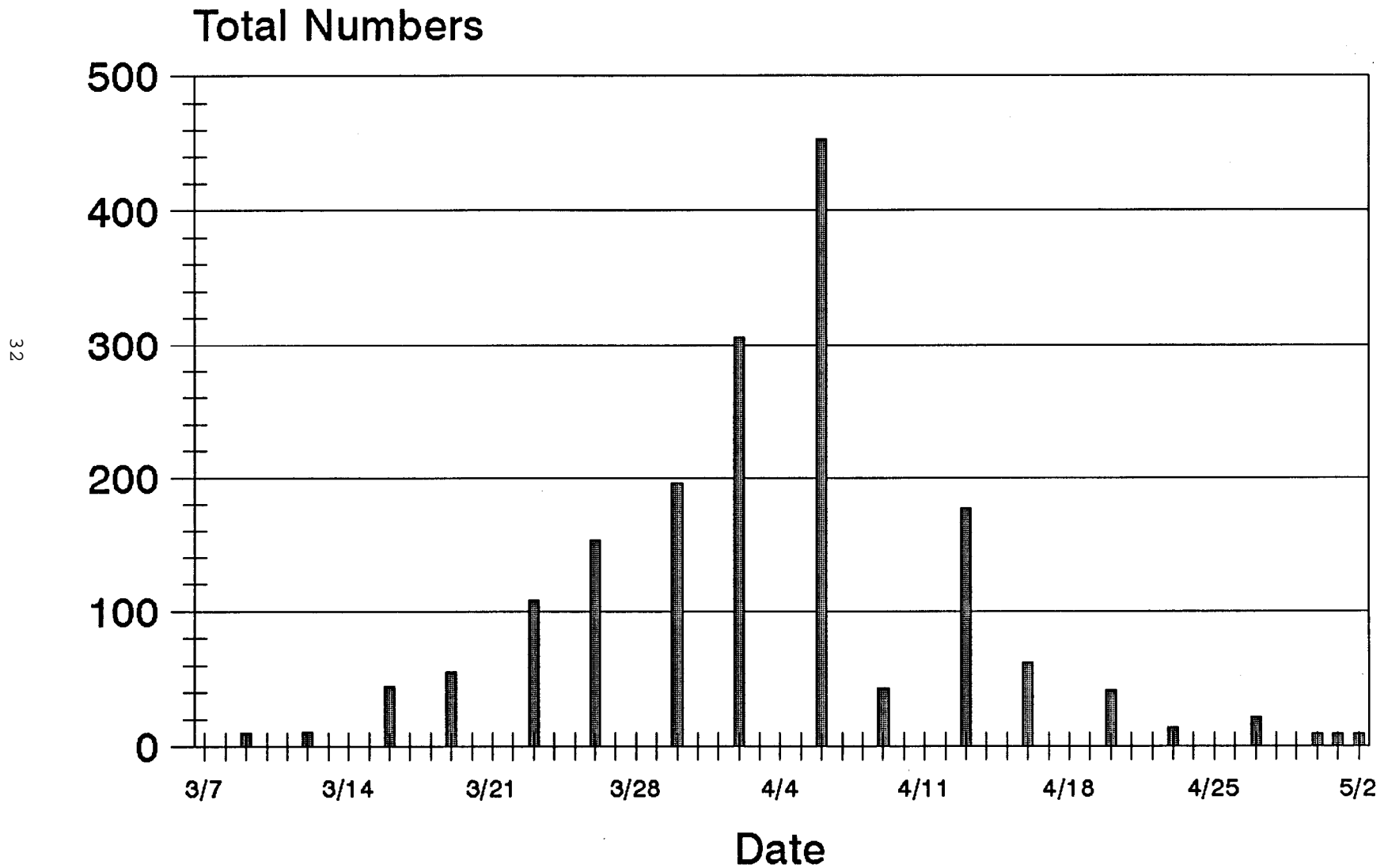
n=62

31



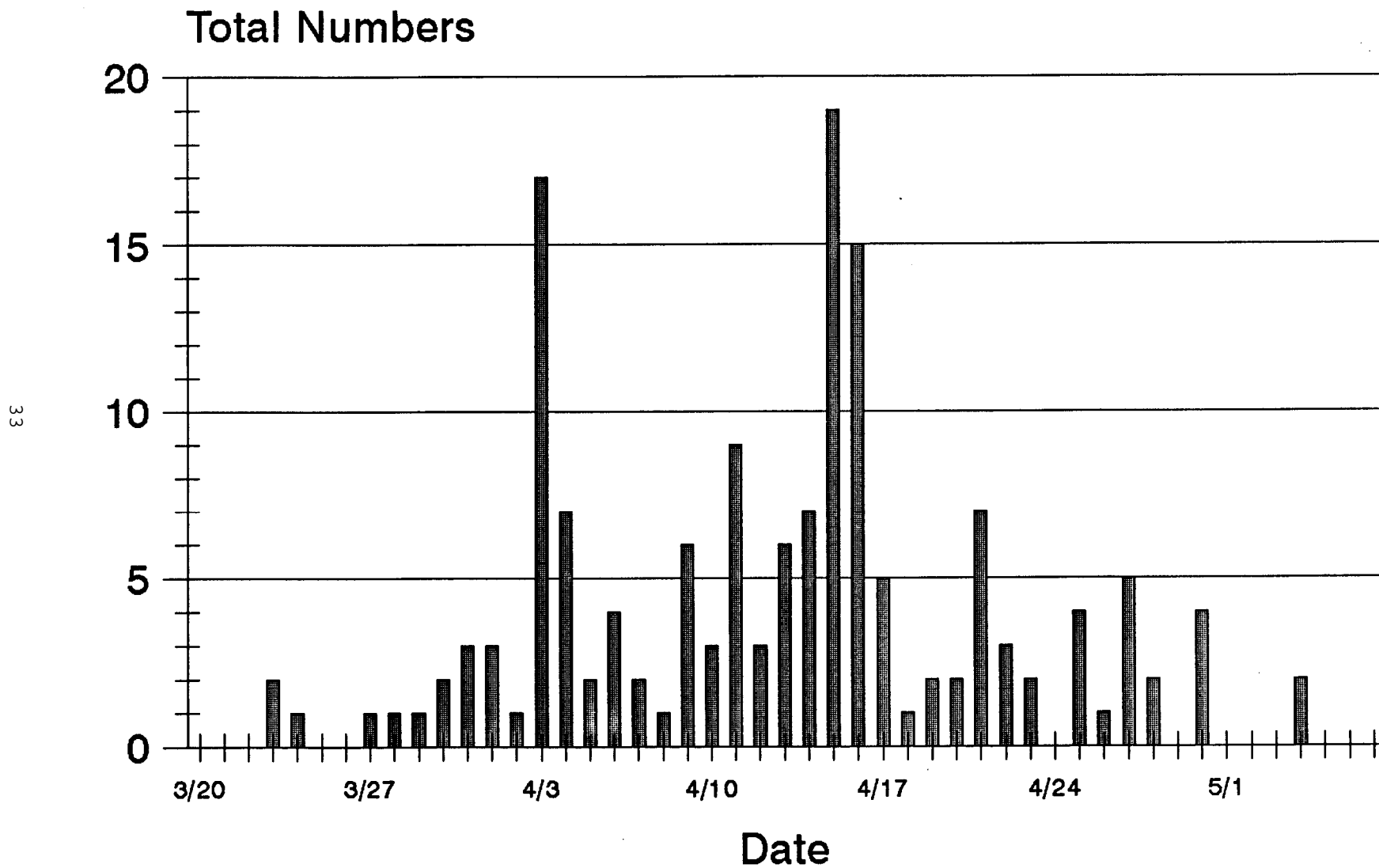
SAWTOOTH STEELHEAD RUN TIMING

n=1,705



EAST FORK STEELHEAD RUN TIMING

n=156



Appendix D. Sawtooth Hatchery chinook smolt releases and adult returns, 1979-1993.

Brood year	Release year	Number released	Adult Returns ^a			Total returns	%
			3-year	4-year	5-year		
1979	1981	None	-	-	291	-	inc.
1980	1982	None	17	66	165	248	inc.
1981	1983	185,375	49	1,182	796	2,027	1.08
1982	1984	230,550	292	922	875	2,086	.91
1983	1985	420,060	51	452	1,318	1,821	.43
1984	1986	347,484	17	86	190	293	.08
1985	1987	1,185,061	80	286	164	530	.05
1986	87-88	1,705,500	412	1,212	297	1,921	.11
1987	88-89	2,092,000	112	201	63	376	.02
1988	89-90	1,895,600	68	496	480	1,044	.05
1989	90-91	652,600	45	78	(1994)	-	inc.
1990	91-92	1,273,400	29	(1994)	(1995)	-	inc.
1991	92-93	774,583	(1994)	(1995)	(1996)	-	inc.

East Fork chinook smolt releases and adult returns

Brood year	Release year	Number released	Adult Returns ^a			Total returns	
			3-year	4-year	5-year		
1979	1981	-	-	-	69	69	inc.
1980	1982	-	-	26	59	85	inc.
1981	1983	-	-	193	102	295	inc.
1982	1984	-	-	87	181	268	inc.
1983	1985	-	22	90	519	631	inc.
1984	1986	108,700	1	23	51	75	.06
1985	1987	195,100	6	55	27	88	.045
1986	1988	249,200	22	106	32	160	.064
1987	1989	305,300	12	23	23	58	.019
1988	1990	514,600	7	27	65	99	.019
1989	1991	98,300	15	18	(1994)	-	inc.
1990	1992	79,300	6	(1994)	(1995)	-inc.	
1991	1993	35,172	(1994)	(1995)	(1996)	-	inc.

^a Age classes based upon the following lengths:

- 3 yr. old: < 64 cm
- 4 yr. old: 64 to 82 cm
- 5 yr. old: >82 cm

Adult returns include an unknown number of natural fish.

Appendix E. Smolt distribution; chinook brood year 1991, steelhead brood year 1992.

Hatchery rearing	Stock	Destination	Weight	Number per lb	Number released	Date released
CHINOOK						
Sawtooth		Sawtooth weir	4,430	24.7	109,753	4/93
Sawtooth		Sawtooth weir	16,100	25.5	414,972	10/92
Sawtooth		East Fork weir	1,549	22.7	35,172	4/93
Sawtooth		Upper Salmon	7,660	25.0	198,039	10/92
Sawtooth		Upper Salmon	1,973	26.3	51,819	4/93
		Totals	31,712		809,755	
STEELHEAD						
Hag Nat	(Pah)	Sawtooth weir	12,400	4.8	59,850	4/93
Hag Nat	(Pah)	Sawtooth weir	138,000	4.8	669,600	4/93
Hag Nat	(Saw)	Hazard Creek	18,075	5.1	92,841	4/93
Hag Nat	(Saw)	Warm Spr. Bri.	95,470	4.7	454,475	4/93
Hag Nat	(Saw)	Hammer Creek	44,575	4.7	211,006	4/93
Mag Val	(Pah)	Sawtooth weir	24,960	4.7	117,300	4/93
Mag Val	(Dwo)	East Fork weir	62,310	6.3	391,000	4/93
Mag Val	(Pah)	East Fork weir	16,890	6.3	106,400	4/93
		Totals	412,680		2,102,472	

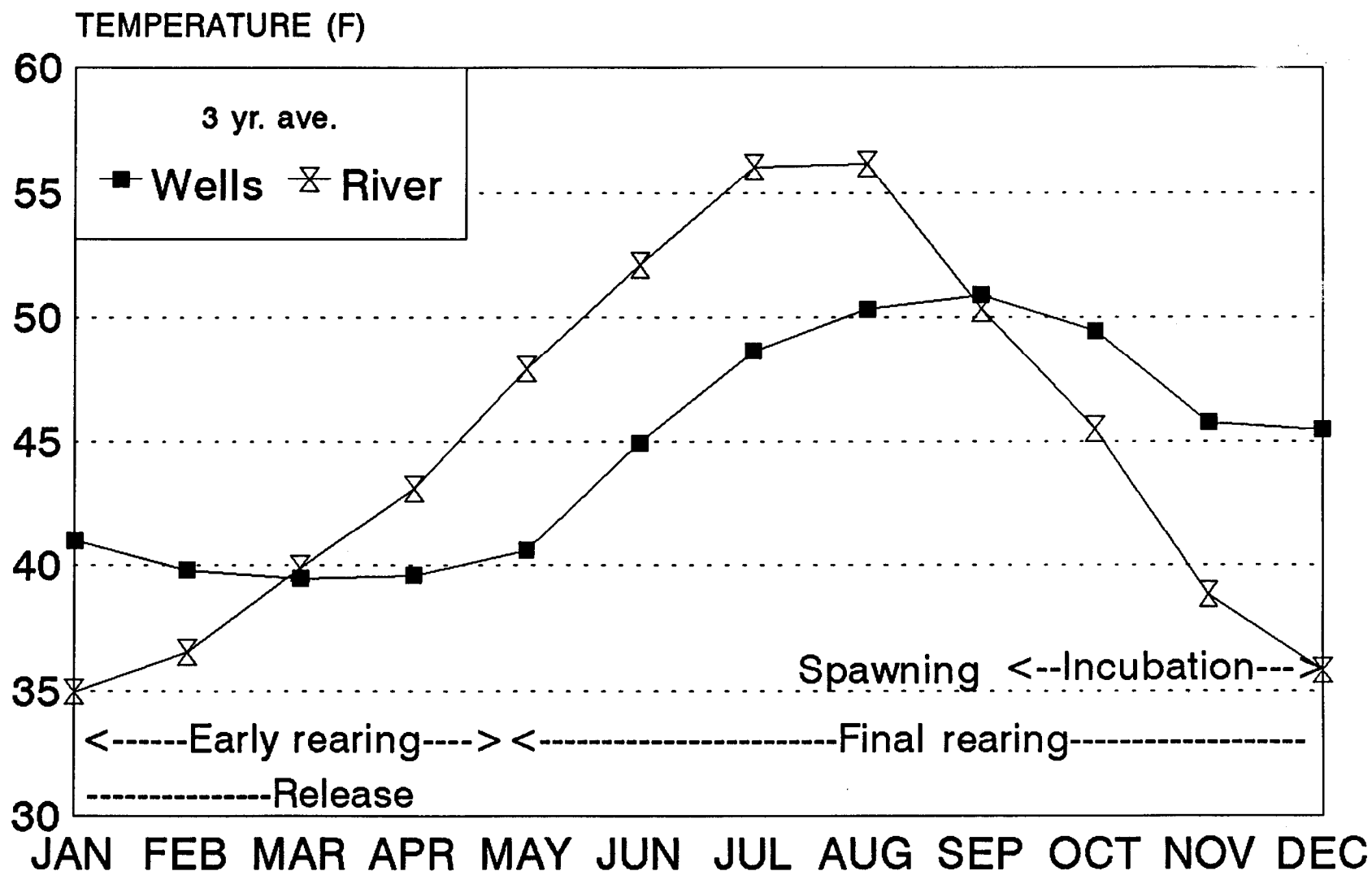
Appendix F. Survival table for chinook (brood year 1991) and steelhead (brood year 1992) from green eggs to released smolts, at Sawtooth and East Fork sites.

	Green egg number	Eyed egg number	Percent survival	Released smolts	Percent survival from green
CHINOOK					
	Sawtooth fish				
	922,000	794,800	86.2	774,583	84.0
	East Fork fish				
	40,400	36,500	90.3	35,172	87.1
Totals	962,000	831,300		809,755	
STEELHEAD					
	Sawtooth fish				
	1,406,400	1,182,000	84.1	843,831	91.5
	East Fork fish				
	150,800	135,200	89.7	106,400	70.5
	Pahsimeroi				
	3,222,600	2,454,000	76.1	1,879,700	58.0
Totals	1,044,440	3,771,200		2,829,931	

^aAll steelhead raised at other hatcheries.

SAWTOOTH FISH HATCHERY

WELL VS. RIVER TEMPERATURES, 1991-1993



Appendix H. Water quality analysis of the Salmon River.

	1992	1985
<hr/>		
<u>Nutrients</u>	<u>mq/L</u>	
T. Ammonia as N	0.043	0.045
T. NO ₂ + NO ₃ as N	0.073	0.088
T. Kjeldahl Nitrogen as N	<.05	0.26
T. Phosphorus as P	<.05	0.02
Ortho Phosphate as P	0.019	<.003
<u>Minerals</u>	<u>mq/L</u>	
Sp. Conductance (umhos/cm)	157	135
Hardness as CaCO ₃	68	62
T. Alkalinity as CaCO ₃	74	63
Bicarbonate Alk. as CaCO ₃	74	63
Calcium	24	20.8
Magnesium	1.9	1.8
Sodium	7.0	3.8
Potassium	0.7	<1
Fluoride	0.85	0.58
Sulphate as SO ₄	5	<6
<u>Total Metals</u>	<u>ug/L</u>	
Arsenic, Total	<10	<10
Boron, Total	<80	1
Cadmium, Total	<1	<1
Chromium, +6	<10	<50
Chromium, Total	<10	<50
Copper, Total	<10	<10
Iron, Total	20	120
Lead, Total	<5	<50
Manganese, Total	<10	10
Mercury, Total	<.5	<.5
Nickel, Total	<10	<50
Silver, Total	<1	<1
Zinc, Total	<2	<1
<u>Miscellaneous</u>		
Turbidity (NTU)	<1	1.8
pH (SU)	8.0	8.1
Total Cyanide (mg/L)	<.005	<.005
Total Residue	-	97

Appendix J1. Summary of spring chinook smolt releases and marks.

Date tagged	# Fish marked	Mark/Code	Purpose	# fish released	Release site	Release date
SAWTOOTH						
9/92	16,249	Ad-10-42-20	US/CAN-LD	16,226	Saw	10/92
9/92	15,965	Ad-10-42-19	US/CAN-LD	15,942	Saw	10/92
9/92	17,396	Ad-10-50-24	US/CAN-LD	17,387	Saw	10/92
9/92	15,441	Ad-10-50-23	US/CAN-LD	15,433	Saw	10/92
9/92	22,333	Ad-10-50-28	US/CAN-MD	22,331	Saw	10/92
9/92	17,462	Ad-10-50-30	US/CAN-MD	17,460	Saw	10/92
9/92	21,599	Ad-10-50-29	US/CAN-MD	21,597	Saw	10/92
9/92	101,273	Ad-10-49-14	US/CAN-HD	101,227	Saw	10/92
9/92	15,570	Ad-10-50-25	US/CAN-HD	15,563	Saw	10/92
9/92	21,975	Ad-10-50-26	US/CAN-HD	21,967	Saw	10/92
9/92	22,254	Ad-10-50-27	US/CAN-HD	22,246	Saw	10/92
9/92	113,200	Ad-10-49-13	US/CAN-HD	113,076	Saw	10/92
9/92	14,532	Ad-10-43-11	US/CAN-HD	14,517	Saw	10/92
9/92	104,953	RV-10-49-12	Supple-HD	104,890	U.Sal	10/92
9/92	23,300	RV-10-50-01	Supple-MD	23,257	U.Sal	10/92
9/92	16,114	RV-10-50-03	Supple-MD	16,070	U.Sal	10/92
9/92	21,062	RV-10-50-02	Supple-MD	21,018	U.Sal	- 10/92
9/92	10,327	RV-10-43-13	Supple-LD	10,309	U.Sal	10/92
9/92	22,518	RV-10-43-13	Supple-LD	22,495	U.Sal	10/92
9/92	21,408	AD-10-50-31	US/CAN-+BKD	21,408	Saw	4/93
9/92	24,434	AD-10-50-33	High BKD	24,261	Saw	4/93
9/92	22,336	AD-10-50-35	High BKD	22,336	Saw	4/93
9/92	20,875	AD-10-50-36	High BKD	20,702	Saw	4/93
9/92	21,565	AD-10-50-32	US/CAN-HD	21,392	Saw	4/93
9/92	52,167	RV only	Supplemnt	51,819	U.Sal	4/93
Totals	776,308			774,583		
EAST FORK						
9/92	35,570	LV-Only	EF release	35,172	U.E. Fork	4/93
Totals	35,570			35,172		

Appendix J2. Summary of steelhead smolt releases and marks.

Date marked	Rearing hatchery	Number	Marks	Stock	fpp	Release site	Purpose
Sawtooth Stock							
11/92	HNFH	6,031	LV-10-50-17	Saw	5.24	Haz Cr.	Accli.
11/92	HNFH	1,448	LV-10-50-18	Saw	5.24	Haz Cr.	Accli.
11/92	HNFH	14,354	LV-10-50-17	Saw	4.89	Haz Cr.	Accli.
11/92	HNFH	5,877	LV-10-50-18	Saw	4.89	Haz Cr.	Accli.
11/92	HNFH	8,772	LV-10-50-19	Saw	4.89	Haz Cr.	Accli.
11/92	HNFH	10,914	LV-10-50-19	Saw	4.82	Warm Spr.	Accli.
11/92	HNFH	3,023	LV-10-50-18	Saw	4.82	Warm Spr.	Accli.
11/92	HNFH	1,708	LV-10-49-46	Saw	4.49	Ham Cr.	Accli.
11/92	HNFH	15,607	LV-10-49-46	Saw	4.79	Ham Cr.	Accli.
11/92	HNFH	15,402	LV-10-49-47	Saw	4.79	Ham Cr.	Accli.
11/92	HNFH	4,352	LV-10-49-47	Saw	4.79	Ham Cr.	Accli.
11/92	HNFH	<u>17,177</u>	LV-10-49-48	Saw	4.79	Ham Cr.	Accli.
Total		104,665					
East Fork Stock							
11/92	MV	5,731	AD-10-50-9	EFB	6.2	upprEF	Contri.
11/92	MV	20,634	AD-10-50-9	EFB	6.1	upprEF	Contri.
11/92	MV	<u>80,025</u>	None	EFB	5.7	upprEF	Contri.
Total		106,390					

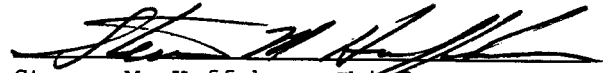
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